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ABSTRACT

Studying 40 branch offices of a large brokerage firm, the investigator attempted to develop a framework for theoretically and operationally defining the concept of interdependence in organizations. After defining task, position-role, social, and skill interdependence, the author explores the consequences of differentiation in terms of the well-being of employees and the performance of their groups. He found that the correlation between the modes of interdependence was weak or negative. (Author/DW)

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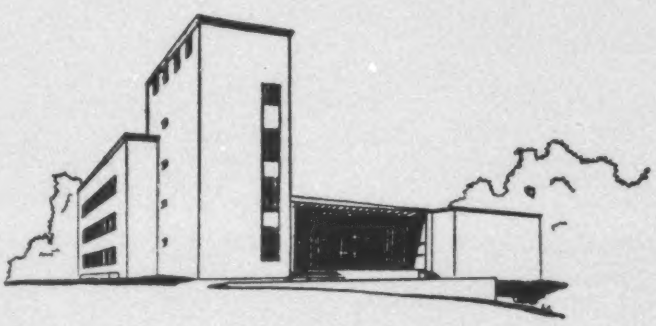

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Differentiation, Interdependence and Performance in Formal Organizations

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Abstract

This paper attempts to develop a framework for defining the concept of interdependence theoretically and operationally. A distinction is being made between task, position-role, social and skill interdependence. The significance of these distinctions for outcome variables is discussed. Data descriptive of members of brokerage offices reveal weak or negligible intercorrelations among the modes of interdependence. Social interdependence appears to be the best predictor of organizational or group performance. The implications of the findings are discussed.

Differentiation, Interdependence and Performance in Formal Organizations

The recent literature on small group behavior and complex organizations shows a growing interest in differentiation and integration. This paper attempts to explore some of the aspects which are related to differentiation and integration.

One of the most salient features of complex organizations is the existence of division of labor which results in their members having to coordinate their activities. On the level of departments Lawrence and Lorsch (1967) have analyzed the integration of differentiated units. The greater the differentiation, the greater the interdependence and therefore the greater the need for integration. Lawrence and Lorsch's (1967) paradigm of differentiation and integration has also yielded insights about the consequences of the discrepancy between the level of differentiation and the corresponding degree of necessary integration. They showed that within the range of a certain amount of differentiation those organizations which achieved a corresponding degree of integration performed better than organizations which failed to reach the necessary level of integration. The intensive research on frictions between the incumbents of staff and line positions has similarly shown that such modes of role differentiation are not always associated with coordination or mutual adjustment (Strauss, 1964). Dalton (1959) for example shows vividly that many behind-the-stage battles and coalition formation processes take place among interdependent organizational components who ought to complement each other like the pieces of a jigsaw puzzle. The interdependence and complementarity due to (role) differentiation is lucidly summarized in the notion of "the need for joint decision making" (March and Simon, 1958). Functionally differentiated

components such as specialists or department members do not have the freedom to refrain from collaboration. They must. Yet the above cited references suggest that differentiation and interdependence do not always result in cooperation and integration. The failure to match differentiation with integration may lead to inadequate outcomes both from the perspective of the group or organization and from the perspective of the members. This statement may hold for both small group behavior and organizational behavior.

A conceptual framework

Perhaps the term interdependence is the most suitable term to encompass the different aspects of interrelated individuals. Interdependence is a very difficult concept to define both theoretically and operationally. Interdependence as reflected by the above considerations involves at least four concepts.

1) task interdependence
2) role interdependence
3) social interdependence
4) skill or knowledge interdependence

Task interdependence is the interrelatedness of a set of discrete operations such that each operation may have consequences for the completion of some of the other ones. Any operation or task which is partitioned into subtasks result in some dependency; the interdependence is rooted in the task level.

Role and positional interdependence is the interconnectedness of a set of role players who are engaged in a concerted action. It can be described as the normatively expected exchange of inputs and outputs to complete a common task.

Operationally task and role interdependence may be hard to disentangle. For example three physicians at the operating table carrying out an operation may each perform part of the task and hence they will be task interdependent. The operation consists of actions such as cutting, sewing, and monitoring which are complementary and which require coordination. It is the set of interrelated tasks which forces the three doctors to play cooperative roles and to concert their actions.

Social interdependence can be defined in terms of the reward system. If the actions for the attainment of group goals has motivational ramifications in that the distribution of rewards is tied to both individual and group performance there exist social interdependence. Members may be interdependent competitively and/or cooperatively (Cartwright and Zander, 1967: 411-415). Perhaps the term goal or need interdependence is more appropriate. Dimensions such as social exchange, cohesiveness and harmony can be used to describe social interdependence.

Finally there is the concept of skill or knowledge interdependence or specialization. Specialization is the differentiation of group members due to training, expertise and experience. The complementarity, if any, is vested in individuals and not in the expectations that are inherent to their assigned tasks and roles. Individuals who are placed in positions to carry out certain tasks may or may not be differentiated with respect to training, experience, education or other investments acquired during various socialization processes. In most cases the expertise and experience which an individual brings with him into the work context is relevant for the adequate performance. However, it is important that a distinction be made between a set of actors who are interdependent because their tasks are interdependent and a set of actors who are interdependent because they accomodate different skills or knowledge. Thus specialization among a set

of members will reinforce task and role interdependence if they carry out tasks the completion of which is contingent upon each other. For example, three physicians in the earlier example will be more interdependent on one another if they represent three specializations, e.g., anesthetics, obstetrics, and general surgery. The different backgroundof role-interdependent individuals adds further weight to their having to rely on one another. On the other hand, it is also conceivable that individuals represent different specialized skills or expertise while being independent, when differentiation is not relevant to adequate role performance. A group of three secretaries of the United Nations who have typing skills for French, German, and Spanish, respectively, do not have to collaborate to achieve adequate role performances, nor does the exchange of knowledge enhance performance.

In this paper we shall examine how these conceptual distinctions are interrelated. Given a set of operational definitions of these concepts it is of interest to explore the consequences of differentiation in terms of the well being of employees and the performance of their groups. This will be done by examining 40 brokerage offices. In general, it is expected that the various modes of interdependence will be associated with each other such as to enhance outcomes. If the numbers of the brokerage offices are highly differentiated with respect to their skills there is a greater need for collaboration and harmony to be effective; this could hold both for the group as a whole as well as its members. This study will explore the degree to which the above modes of interdependence go together and how they affect the outcomes of the individuals and the groups they belong to.

Method

This study is based on data collected in forty branch offices of a large brokerage firm. These units of analysis were selected as a purposive sample from among all American offices of the firm. The firm operates through these branch offices so that geographically this organization is highly dispersed. The brokerage firm performs the functions of buying and selling securities, mutual funds and commodities for its clients. In recent years it has diversified its operations to include underwriting, investment banking and principal transactions. The composition of business varies across offices. For example, mutual funds and bonds may constitute the bulk of transactions for one office, while securities and commodities are more important in other offices.

All forty offices have similar authority structures. Each office is headed by an office manager. The size of the office varies from 31 to 141 employees. The offices are organized around salesmen each of whom serves a roster of clients. Every office has a supportive component, the operations personnel.

The data were collected to provide information to the firm on determinants of office performance. Within each office 50% of the salesmen were selected by following a systematic random sampling procedure. This sample of respondents received a questionnaire that provided most of the relevant information for the current study. The other 50% of each office's personnel received a totally different questionnaire that was used for a planned change effort involving the so called feedback method. The response rate for both samples was approximately 90%. The respondents of the first set were requested to fill out a questionnaire which included items that are relevant for the assessment of interdependence. These items provide the possibility for the construction of a number of scales tapping some of the

subconcepts of interdependence. A description of these scales may further facilitate our understanding of the distinction between these subconcepts.

Measurement of interdependence

The questionnaire included a set of items describing sixteen areas of business with which a salesman was more or less familiar, or in which he enjoyed a certain amount of skill or expertise. Some of these areas deal with traditional brokerage business transactions involving the buying and selling of stocks; others deal with relatively non-traditional activities such as underwriting, pension plans and "buy-sell-merge" transactions. Each respondent was asked to rate his own confidence in each of these sixteen areas by indicating on a five point scale how confident he felt in these areas. The sixteen ratings allowed for the construction of a profile for each employee of each office who returned the questionnaire.

It is possible to compute a value which describes how similar or how different two individuals are with respect to a set of skills.

We represent each employee as a point in a 16-dimensional space, and the distance between two profiles (or vectors) is simply a number associated with that pair of individuals. The most common distance function is that suggested by Cronbach and Gleser (1955), the well known Euclidean function. Let $X = (X_1, X_2, X_3, \ldots X_n)$ and $Y = (Y_1, Y_2, \ldots\ldots, Y_n)$ be two vectors where X represents the vector of one individual and Y represents the vector of another individual. The Euclidean distance between the two vectors is

$$D_{XY} = \left[\sum_{i=1}^{n} (X_i - Y_i)^2 \right]^{1/2}.$$

The dissimilarity between two vectors representing the proviles of X and Y is equal to the sqare root of the sum of the squared differences between their scalars.

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For each office all profiles were related to one another so that 40 distance matrices were obtained. Two parameters descriptive of these distance matrices were obtained: the mean and the degree of clusterability. A high mean Euclidean distance implies a high amount of skill differentiation or specialization. In addition, a clusterability measure was obtained by way of a hierarchical clustering procedure (Johnson 1967). Johnson provides an algorithm which generates a ratio that varies from 1 to 0. The ease with which one can form a fixed number of clusters can be assessed by this ratio. For example, an office which has a ratio of .5 when three "clumps" of salesmen are considered is viewed as being more specialized than an office that has a ratio of .8 when a three cluster solution is taken. The higher the ratio, the greater the clusterability. If an office is highly clusterable there is little specialization

The questionnaires included a number of items which tap some of the other mentioned aspects of interdependence. In the subsequent analysis the following scales will be used.

Role interdependence (reliability .49), consisting of the two items asking: a) whether the respondent generally worked alone or with others, b) whether the respondent was dependent on others for advice and other decisional inputs.

Social interdependence (reliability .82), consisting of four items tapping the nature of affiliative behavior such as competitiveness versus cooperation, team-relationship and cohesiveness.

In addition, there is a scale called workgroup process (reliability .89) developed by Taylor (1971) as part of a survey-feedback questionnaire which describes social interdependence in a somewhat different way. This scale can be used to compute the test-retest reliability with respect to

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the social interdependence scale and was obtained from the other (random) half of the employees investigated: i.e., those employees of each office who received the second questionnaire. This test-retest or "replication reliability" is .56.

Unfortunately, the data set does not include information about task interdependence. It could be assumed that the nature of the operations of a brokerage office implies a low degree of task interdependence. The tasks of one broker may not have immediate consequences for the tasks of the other brokers. This interdependence, if any, is "pooled". However, data that are pertinent to task interdependence are not available so that this study can only examine part of the analytic distinctions which were described before.

Results

Table 1 shows the correlations between the three questionnaire measures of interdependence and the two indices of specialization. Since the role interdependence scale has a rather low Spearman-Brown reliability, the matrix also includes the "purest" item tapping the extent to which a person has a one person job. This item is "pure" in that it has high face validity.

-table 1 about here-

While the measures of social interdependence and "workgroup process" are not related to the specialization measures, there is a weak but consistent correlation between role interdependence and specialization ($r = -.36$ or $-.28$). All the questionnaire scales are scaled such that a high score implies interdependence and a low score independence. Therefore the results suggest that in heterogeneous offices there are fewer collaborative, role interdependent employees. In contrast in offices

where everybody is rather similar there seems to be a tendency towards cooperation, i.e., role interdependence is high. Furthermore, the low correlation in table 1 can be explained by pointing out that specialization within role-sets may be independent of the specialization on the office level

It is conceivable that the relationship between specialization and role interdependence is affected by social interdependence. If employees colaborate to meet their individual goals such collaborative relationships reflect a high amount of social interdependence. Employees may exchange mutual support rather than more tangible commodities such as expertise. Table 2 examines the extent to which social interdependence affects the relationships between specialization and role interdependence. It shows the product moment correlations between these latter variables for offices which are either high or low on the "workgroup-process" index. A high score on this index indicates that the members of an office express harmony, strong team spirit and compatibility of individual goals. This latter indicator, rather than the social interdependence index, was used in order to have a safeguard against specific method variance and the confounding variance of social interdependence and role interdependence.

-table 2 about here-

The negative relationship between specialization and role interdependence which was established in table 1 between role interdependence and specialization seems to hold only in those offices where employees tend to view their colleagues as having competing goals (e.g., $r = -.37$ versus $-.08$). If employees perceive their social environment as being antagonistic, noncohesive and having a minimum of complementary objectives, they are likely to collaborate only with those who share their expertise or occupational background. They are very unlikely to seek advice from

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someone who is an expert in a different set of skills. The surprising finding is the absence of such a correlation in offices where everybody views his goals and value as being compatible and integrative with those of his colleagues. In such an office the salesman is equally likely to collaborate with someone who is similar in expertise as with someon who is involved or associated with areas that are different from his own. Apparently, specialization stimulates antagonism and hostility among the various role-sets or clumps of closely knit networks.

It was further examined whether the relationship between skill interdependence and role interdependence was contingent upon the importance of specialization. In some offices there is a strong emphasis on specialization while in other ones different contributions are stressed. The emphasis on specialization was measured by an item tapping the instrumentality of "being a specialist" for advancement. If an organization reinforces specialization it seems plausible that skill differentiation does enhance the merging of skills. If it does not reward complementarity the opposite would be expected; under such conditions people could avoid working together with those with different skills

-figure 2 about here-

Figure 2 illustrates the striking contrast between the two sets of offices which differ in their emphasis on specialization for advancement in the organization. The specialization measure which is used is the average distance. In offices where specialization is emphasized there is a congruency between specialization and role interdependence, i.e., in those organizations there is a tendency for people to collaborate with employees who are ~~identical~~ different. In contrast, when specialization is not emphasized, people with organizational level seems to be incongruent or dissonant with such a reward-

contingency structure. Individuals in such offices tend not to work together nor ask for advice or suggestions unless the organization is very homogeneous.

Interdependence and performance

The question may be raised whether these pattersn of interrelationships have any significance for the performance of the salesmen. Data from company records provided information on various criteria of organizational effectiveness including market share, productivity, increase in level of productivity, efficiency and turnover of personnel and turnover of customers. Furthermore the questionnaire included some scales tapping psychological outcomes.

Although these performance indicators are not related to role interdependence and specialization they correlate rather strongly with social interdependence. This mode of interdependence is conductive to anxiety reduction; the correlation between this measure and a scale measuring anxiety (e.g. feeling of having a jumpy job, sleeplessness because of job related strain) correlates -.35 where the sign of the coefficient signifies that the greater the feeling of team belonginess and harmony, the less prevalent are feelings of psychological strain. Social interdependence is also strongly related to variables such as the number of new customers acquired during the previous years ($r = .41$) and the amoung of money lost due to transactional errors ($r = -.35$). Of course these performance indicators are standardized so as to avoid the confounding effect of size.

Such findings are consistent with those of Pelz (1967) who examined R & D groups. R & D groups share with brokerage offices the "pooled interdependence" (Thompson, 1967) among members. Pelz argues that harmony and support are needed to alleviate the anxieties due to the small differences

in viewpoints among similar specialists which challenge the security of an individual scientist.

In our data however, role interdepence which is highest when employees are similar is not related to performance. This inconsistency may be due to role interdependence being a variable descriptive of a role-set rather than descriptive of the total organization. Intraoffice variations in role interdependence may be related to performance but no data exists which pertain to the performance of members of role-sets. Also creativity which is essential for scientific performance and which is stimulated by interaction may be irrelevant for stock brokers.

Following the paradigm of differentiation and integration it was further examined whether the relationships between performance criteria and role and social interdependence are stronger for those units which were most heterogeneous. However, it was found that there is virtually no relationship between role and social interdependence and performance criteria if the analysis is restricted to specialized offices. On the other hand the relationships under discussion were strong to extremely strong for those offices whose personnel composition showed little specialization. Therefore these data do not lend support to the contention that for differentiated units to be effective there is the necessity for integration as reflected by the indices of role and social interdependence.

Conclusions

In conclusion this study has shown that the various aspects of interdependence may be unrelated to one another. Integration does not necessarily follow differentiation. The manifestation of complementarity seem to vary depending on the relative degree of differentiation of personnel: 1) complementarity among individuals who are highly dissimilar and

2) complementarity among individuals who are virtually similar with respect to skill or expertise. It would be interesting to examine the processes that are associated with the propensity to collaborate under these different conditions:

1) Under the first condition one is likely to amalgamate knowledge or other resources if their combination results in the achievement of common goals. There has to be a willingness or a coercion to carry out joint decision making and joing consultation. The process under which highly dissimilar resources become merged is probably more important than the potential for amalgamation. Such processes are stimulated by many possible factors, including the organization's propensity to reinforce specialization. The vivid and famous description of rival engineers and purchasing agents in Strauss' (1964) case study can be interpreted along these lines. The unwillingness on the part of engineers prevents the emergence of joint decision making processes. In the literature on staff-line frictions in complex organizations this unwillingness sometimes obtains a mythical character.

2) Knowledge similarity does not seem to be incompatible with the notion of complementarity. Festinger's classic theory of social comparison processes (1956) depicts in a concise manner how individuals who are as similar as possible may complement one another for the validation of their emotional feelings and judgments. They engage in processes of "matching" and it is this matching which results in the exploration and eventually in Festingerean synthesizing. This does not rule out competitiveness. On the contrary, it may be the disagreement among salesmen which generates energy to obtain good outcomes! Within a homogeneous set of employees there is still enough dissimilarity (in the form of disagreement) which mobilizes individuals to collaborate or to express a feeling of dependency for advice.

In the brokerage office the dissimilarity and hence the complementarity consists of the inequality of decisional uncertainty, judgmental ambiguities or differences in viewpoints among people who are similar enough to discern the relevant aspects of highly specialized problems. Mutual dependencies will develop under such conditions provided outside factors do not inhibit such modes of complementarities as reflected, for instance in the above statements regarding specialization being a vehicle for promotions.

This analysis and interpretation have yielded a more sophisticated and complex view of what interdependence can mean. Unfortunately, we were not able to examine one of the more crucial aspects of interdependence task interdependence as pertinent information is not available. It is more likely that most employees in a brokerage office are not embedded in a network of task interdependent networks having a serial or, reciprocal character. Therefore it would be preferable to include organizations or departments which have different sets of tasks or whose technology makes the members highly task interdependent. This will help the definition and comprehension of the aspects of interdependence. Therefore it will be desirable that future research will focus on units the elements of which display serial or reciprocal interdependence.

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Table 1. Product-moment correlations between specialization and indicators of interdependence (N=40)

Interdependence Indicators	Specialization as measured by Mean Euclidean Distance	Clusterability
Item "one person job"	-.36*	.24
Role interdependence	-.28	.16
Social interdependence	-.03	.21
Workgroup process	-.04	-.08

* $p \leq .05$

Table 2. Comparison of the strength of the relationship between specialization and role interdependence among offices which have low or a high score on the "workgroups - process" measure.

SPECIALIZATION	Workgroup Process		
	Low (N=21)	High (N-19)	P (low-high) Fisher's Z transformation
Average Euclidean distance	-37*	-.08	NS
Clusterability of personnel	.45*	-.12	$p \leq .05$

* $p \leq .05$

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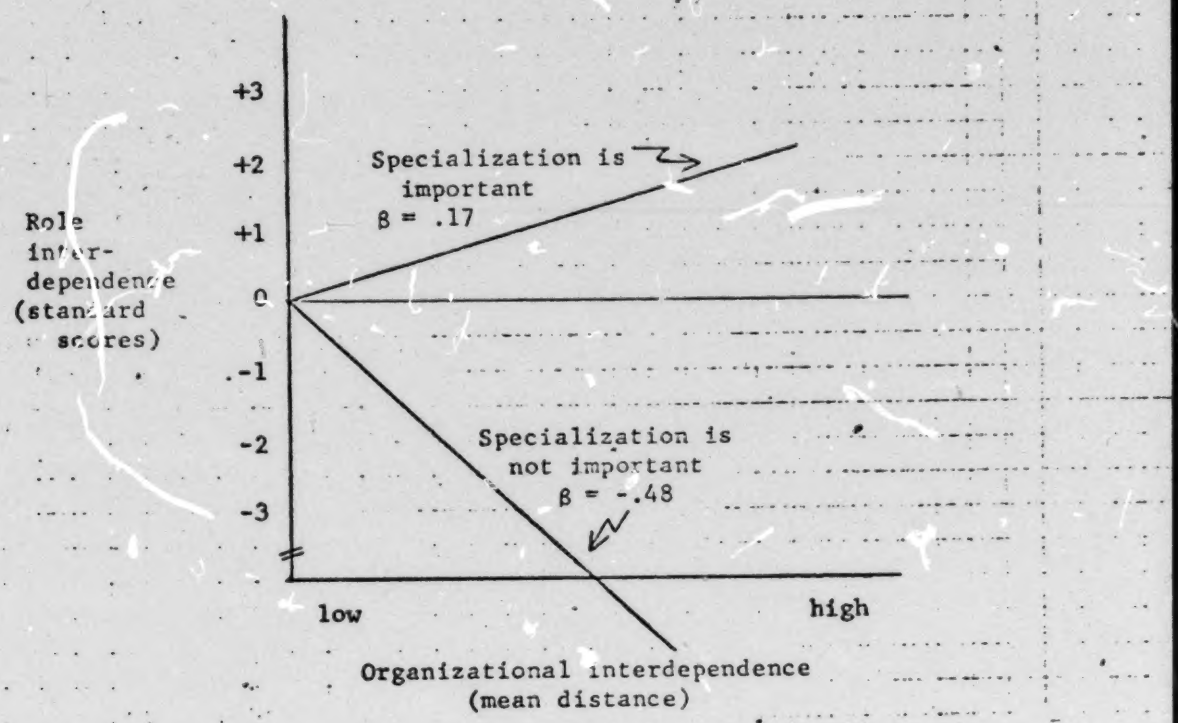

Figure 2. Relationship between organizational and role interdependence moderated by the emphasis on specialization being a vehicle for promotion.